KILLING FROST AND LENGTH OF GROWING SEASON IN VARIOUS SECTIONS OF KENTUCKY.

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(Read before the Kentucky Academy of Sciences, May 5, 1917.)

[Dated: Weather Bureau Office, Louisville, Ky.]

ABSTRACT.

In his operations the farmer every season is confronted with risks due to weather and climate. Among the risks that he faces each season are those of damage by late frost in Spring, early frost in Fall, and a possible shortening of the growing season below that needed for the proper development and ripening of his crops. This paper summarizes and presents in the form of tables and charts the results of a study of the dates in Kentucky of the last killing frost in Spring and first killing frost in Fall, and the length of the growing season considered as the number of days between these dates. The records of the regular stations of the U. S. Weather Bureau, and those of the cooperative stations with 20 years or more of record, were carefully examined and analyzed, employing mathematical methods used in the investigation of statistics and probabilities. The average dates of last killing frost in Spring and first killing frost in Fall, the average number of days in the growing season, and the "standard deviations" from these averages were computed for each station, and consequent risks or probabilities determined.

INTRODUCTION.

In farming operations the farmer every season is confronted with certain climatic and weather risks. Therefore to be successful he should study the climatic conditions of his section, and in some degree at least know the risks that come to him from climatic causes in the raising of any crop. Favorable and unfavorable weather conditions are of the greatest importance to him at all times.

Among the risks that he faces each season is that of damage by late frosts in Spring and early frosts in Fall. This paper presents a summary of the results of a study of the dates of the last killing frost in Spring and the first killing frost in Fall, taken from the records of the various cooperative and other Weather Bureau stations that have been maintained in this State, especially those having a record of 20 years or more.

The cooperative observers are supplied with United States standard thermometers, which are exposed in standardized instrument shelters. The shelter is usually placed over sod with its bottom about 4 feet above ground, bringing the instruments in the shelter to about the height of the eye of the average man.

Frost being the moisture of the air condensed at freezing temperature on plants or other objects near the surface of the earth, the temperature of the surface on which frost appears must therefore necessarily be at or below 32° F. On clear, quiet nights, which are favorable to the formation of frost, the air at the surface of the earth is usually colder than in the thermometer shelter 4 feet or more above the ground, the colder heavier air settling to the lowest point. Also, radiation is greater from a plant surface and from the ground than from the interior of the shelter. Under such conditions, therefore, temperatures within the shelter—and these are the temperatures commonly recorded by our observers—are necessarily several degrees higher than those at the exposed surfaces where frost forms. Obviously, then, killing frosts might occur when the air temperature within the instrument shelter is 35° to 38°F. Regardless of whether or not the temperature in the shelter register as low as 32°F, the Weather Bureau observer records the occurrence of frost in accordance with the following instructions, quoted from Instructions to Voluntary Observers, 1915, page 25, section 60:

Frost.—Occurrence of first and last frost of the growing season should be specially noted.

The terms descriptive of frost will be as follows:

Light, to indicate a frost that has no destructive effect, although tender plants and vines in exposed places may be injured. *Heavy*, to indicate a frost that in itself is severer than a light frost—that is, the deposit of frost is heavier and the temperature falls to a lower point, although the staple products of the locality may not have been generally destroyed. *Killing*, to indicate a frost that is generally destructive of vegetation and the staple products of the locality.

Harmonizing of frost records.

In (making) this study frost records of the various stations were carefully examined and harmonized with the minimum temperatures, general weather conditions, precipitation, frost at neighboring stations, maximum temperature of day previous, location of station and its elevation, and the topography of the country. The frost records of all stations for each year were studied together and carefully charted to harmonize them as far as possible. Whenever the temperature was 32° in Spring and no killing frost was reported afterward, that date was taken as the last killing frost of the season. Also, in Fall the occurrence of the first temperature of 32°F. was taken as the date of the first killing frost, provided no record of killing frost had been made previous to that date. An interesting fact is brought out by Prof. Fassig [1] namely that Fall records of first killing frost are more accurate and reliable than Spring records of last killing frost, because an observer is more apt to note and record the first occurrence of an event of this kind than he is the last occurrence, unless the last occurrence is unusually pronounced.

The records have been studied and analyzed, employing mathematical methods used in the investigation of statistics and probabilities. The average dates of last killing frost in Spring and first killing frost in Fall have been carefully computed; also the standard deviation.[1]

Average or normal condition.

Beside the usual units of measure of the elements that constitute climate, such as degrees of temperature, inches of precipitation, miles per hour for wind movement, percentage of cloudiness, etc., it is found necessary to establish some measure or condition of each element as a base of reference with which to compare the many irregular variations in the actual observation of these elements. The base of reference usually chosen is the average or normal condition, determined by reducing the recorded values of the element to an arithmetical mean. This average does not express the usual, or even expected condition; also rarely is it the condition of greatest frequency. But it does afford a convenient basis for determining the general character of an element in any locality, in that it is a value about which actual values fluctuate. To convey a definite idea of the real

[1] Without particularizing I wish to refer to the following recent papers dealing with the problems of the present paper:

Reed, W. G. & Tolley, H. R. Weather as a business risk in farming. Geogr. rev., New York, 1916, 2:48-53; Abstract in this REVIEW, June, 1916.

Reed, W. G. Probable growing season, this REVIEW, September, 1916.

Spillman, W. J. and others. Average interval curve and its application to meteorological phenomena, this REVIEW, April, 1916.

Marvin, C. F. Elementary notes on least squares, etc., for meteorology and agriculture, this REVIEW, April, 1916.

Fassig, O. L. Period of safe plant growth in Maryland and Delaware, this REVIEW, March, 1914.

Wilson, Wilford M. Frosts in New York. Cornell agric. exper. sta., Bulletin no. 316. Ithaca, N. Y., 1912.

character of a locality as regards any single climatic element, a statement of the average value of the element must necessarily be attended by additional information as to the magnitude and frequency of departures from that average.

Standard deviation.

A measure of the dispersion or variation of the individual observations in any series of observations or data, from the average or mean value, is supplied in the "standard deviation" or those values of the departure which locate the points on a *normal frequency* curve where the curvature changes from convex to concave; that is, points of inflection (see C. F. Marvin, op. cit.).

In the method of least squares the value of the standard deviation is given by the formula, $\sigma = \sqrt{\frac{\Sigma x^2}{n}}$, where σ is the standard deviation; Σx^2 the sum of the squares of the departures from the true mean, and n the total number of observations. In practical calculation the formula as modified by Prof. Marvin is preferable. This formula is $\sigma = \sqrt{\frac{[x^2]}{n} - \left(\frac{[x]}{n}\right)^2}$, where $[x]$ is the algebraic sum of the departures taken from a convenient base number—usually the average taken to the nearest whole number—and $[x^2]$ is the sum of the squares of these departures. The standard deviations given in the tables herewith were computed by means of this modified formula.

Values of the ratio of any departure, x, to the standard deviation for assumed frequencies of x (expressed in percentage) were taken from the article by Spillman and others (loc. cit.), the average interval being the reciprocal of the normal frequency or probability of the occurrence of an event.

These values are given in the following table:

TABLE 1.

Probability.	Frequency.	Average interval.	Value of x/σ
Per cent.		*Years.*	
50	1 year in 2	2	0 ($x=0$)
40	2 years in 5	2½	0.25
33⅓	1 year in 3	3	0.48
25	1 year in 4	4	0.67
20	1 year in 5	5	0.84
10	1 year in 10	10	1.28
5	1 year in 20	20	1.64

The chance of frost occurrence, by the theory of probability, is given in the following table from W. G. Reed in MONTHLY WEATHER REVIEW, September, 1916, page 511.

TABLE 2.—*Chance of frost occurrence (20-year record) when the standard deviations are known.*

Chance of frost.	Chance of safety.	Spring.	Fall.
Per cent.	*Per cent.*	*Date.*	*Date.*
50	50	A_s	A_f
40	60	$A_s+0.25\sigma_s$	$A_f-0.25\sigma_f$
33⅓	66⅔	$A_s+0.48\sigma_s$	$A_f-0.48\sigma_f$
25	75	$A_s+0.67\sigma_s$	$A_f-0.67\sigma_f$
20	80	$A_s+0.84\sigma_s$	$A_f-0.84\sigma_f$
10	90	$A_s+1.28\sigma_s$	$A_f-1.28\sigma_f$
5	95	$A_s+1.64\sigma_s$	$A_f-1.64\sigma_f$

A_s = average date of last killing frost in Spring.
σ_s = standard deviation.
All fractions are added in Spring and dropped in Fall.
A_f = average date of first killing frost in Fall.
σ_f = standard deviation.

RISK OF DESTRUCTIVE FROST IN KENTUCKY.

As a rule the risk of a destructive frost is not so great for farmers in Kentucky as it is for those in many other States, particularly in those States farther north and in those farther south. In Kentucky most of the principal crops are usually planted after the average time of killing frost in Spring, and they mature or are harvested before the average date of killing frost in Fall, the period between these dates usually being of sufficient length for the growing and maturing of most of the staple crops. Occasionally, however, favorable conditions in Spring lead to early planting and the consequent risk of damage from spring frost; again, unfavorable conditions of weather or soil delay planting, which in turn increases the risk of damage from an early fall frost. In Kentucky, killing frosts in Spring refer chiefly to damage to fruit, strawberries, and early garden truck—corn and tobacco being usually not yet planted. In the Fall damage from killing frost refers almost entirely to corn and tobacco; its occurrence usually ends the season for those crops. It not infrequently happens, however, as was the case during the past two years, that these crops are matured and well out of danger before the occurrence of the first freezing temperature or of destructive frost. It should be recognized that the farmer should know and heed the risk he runs and the chances he takes from probable damage by frosts, both in Spring and Fall.

LENGTH OF THE GROWING SEASON.

The length of the growing season, or the period of safety for plant growth, is generally considered to be the number of days in each season between the date of the last killing frost in Spring and that of the first killing frost in Fall; also the average length of the growing season as usually determined is the number of days between the *average* date of the last killing frost in Spring and the *average* date of the first killing frost in Fall. In this study the length of the growing season agrees with the above definition, but the *average* length of the growing season was computed by summing the actual number of days between the date of last and date of first killing frost in each season and taking the mean.

As the chance of safety from killing frost in Spring is 50 per cent when the average date of last killing frost arrives, and also the chance of safety in Fall is 50 per cent when the average date for first killing frost arrives, the chance for safety for the days between these dates is $\frac{50}{100} \times \frac{50}{100}$, or only 25 per cent—a chance that could not reasonably be taken for crops requiring the full growing season to mature. The length of a growing season that has only a 20 per cent risk, or one that is practically sure in four years out of five, was therefore computed. (See Table 2 and fig. 4.) Such a growing season is obviously the same as one in which the risk from killing frost in Spring is 10 per cent, and the risk from killing frost in Fall is also 10 per cent.

Tables 3 and 4 and figures 1 to 4, accompanying this paper, summarize and bring together in a practical way for easy reference results of this frost study.

The map presented in figure 1 shows that the average date of the last killing frost in Spring is latest (Apr. 20) over the central plateau section of the State, comprising the counties from Green, Marion, and Boyle eastward to the Cumberland Mountains and the extreme northeastern

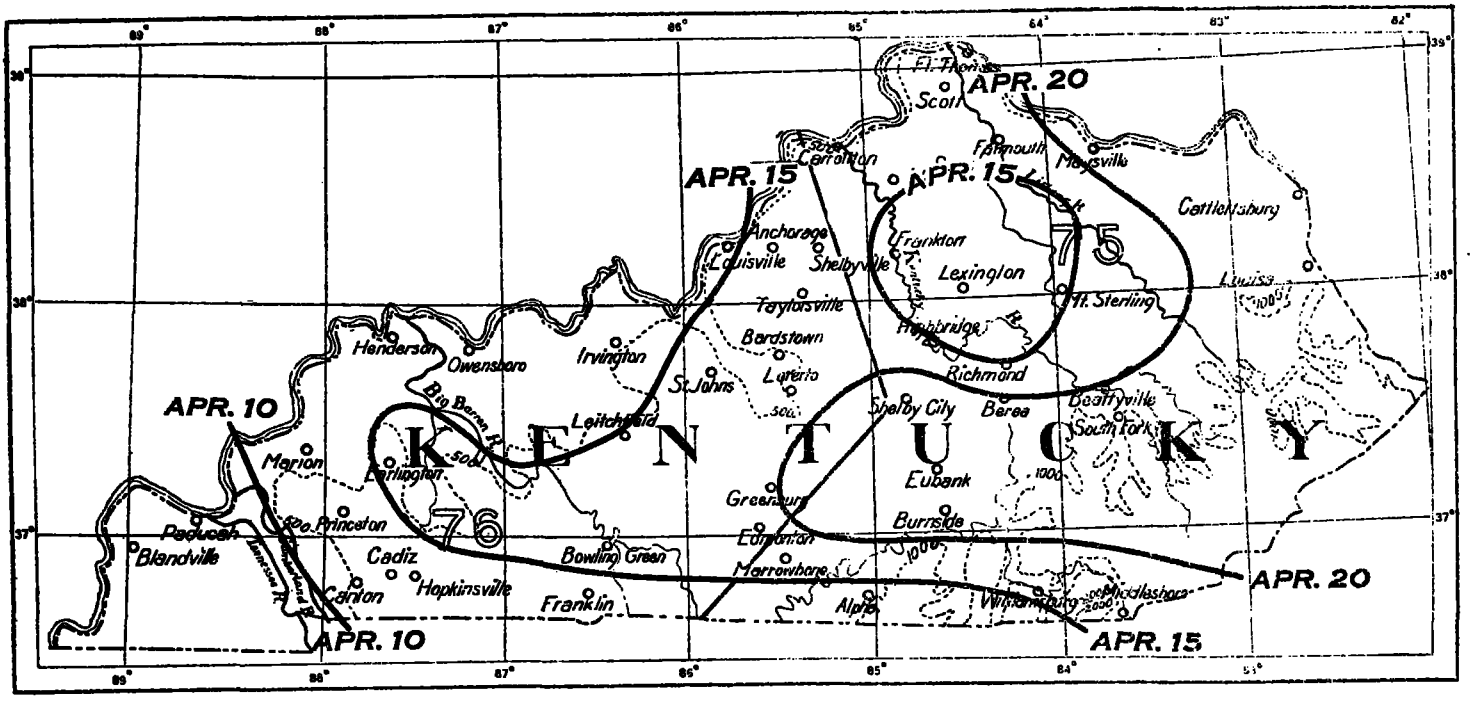

FIG. 1.—Map of Kentucky showing average dates of last killing frost in Spring.
General altitudes above sealevel are shown by the contours for 500 and for 1,000 feet (dotted lines).

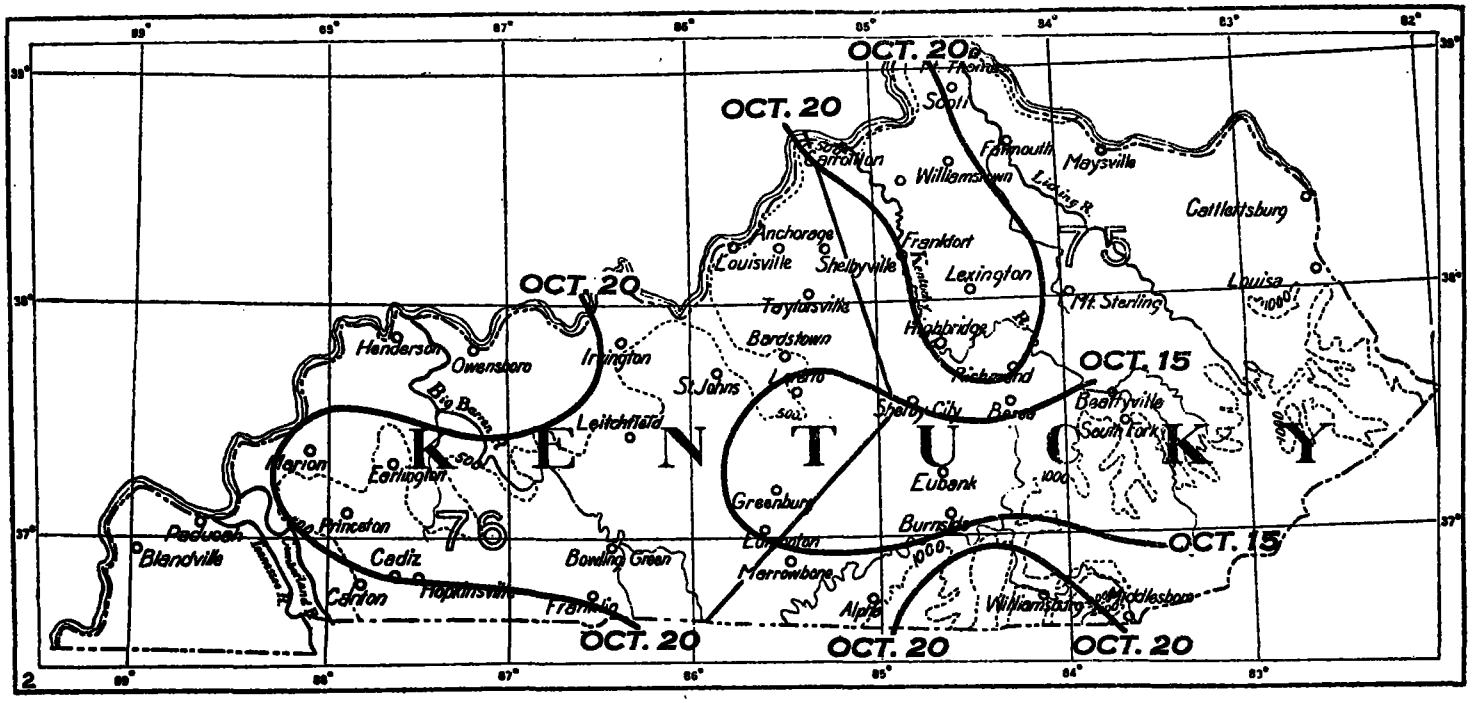

FIG. 2.—Map of Kentucky showing average dates of first killing frost in Fall.

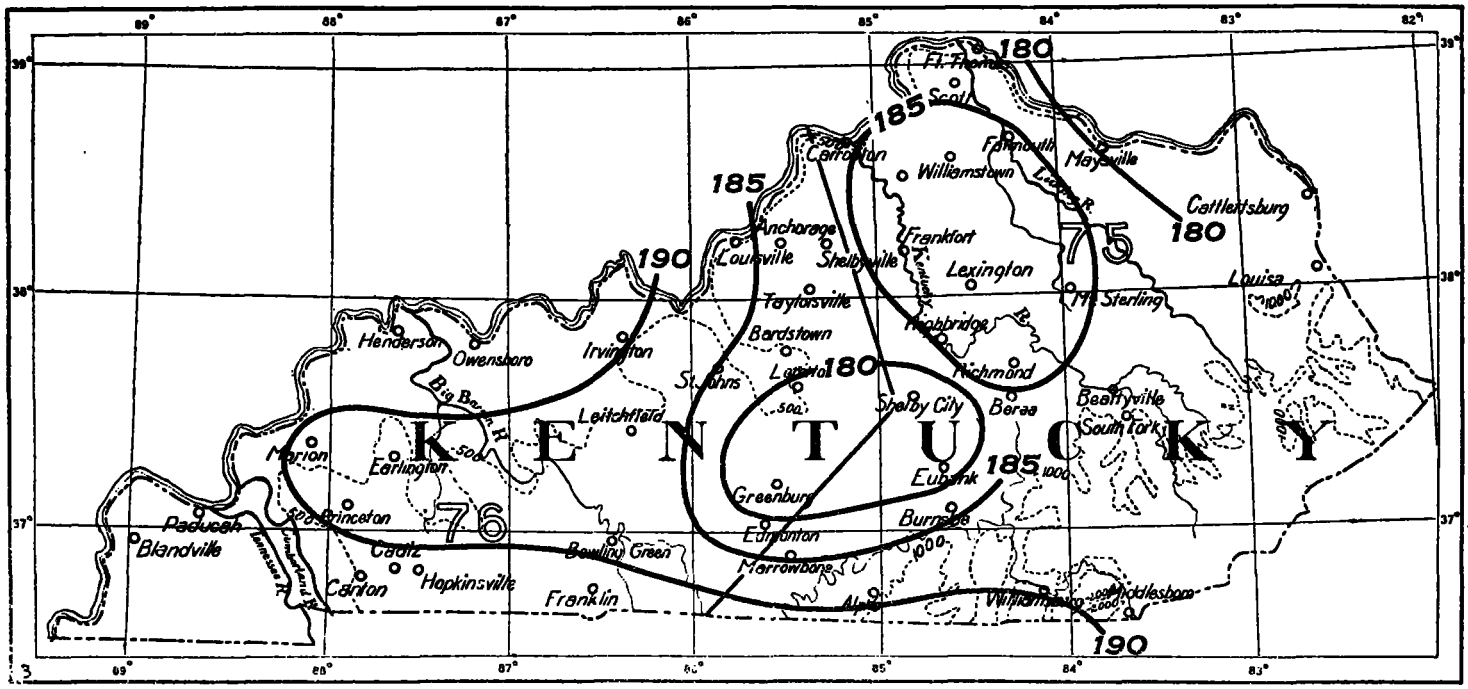

FIG. 3.—Map of Kentucky showing average number of days in the growing season, i. e., the number of consecutive days free from killing frost.

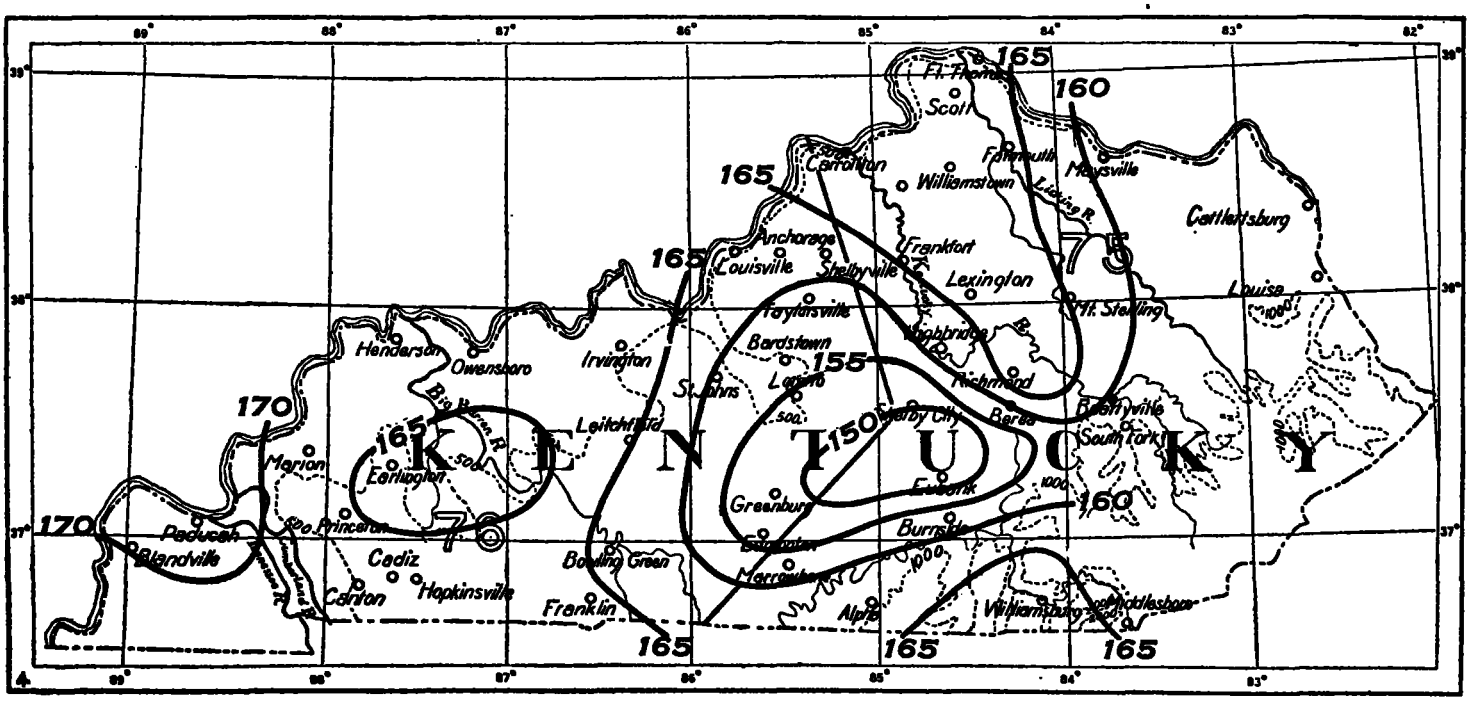

FIG. 4.—Map showing the number of days to be expected in the growing season, 4 years out of 5.

counties from Bracken and Fleming to Boyd. This date is earliest (Apr. 9 to 12) in the extreme western counties, in the counties bordering western Tennessee, and in the counties along the Ohio River as far as up Meade.

Figure 2 shows that in the Fall the earliest average dates of first killing frost (Oct. 13–15) occur over practically the same plateau as the latest average date of last killing frost in Spring; while October 20–23 are the average dates over most of the Blue Grass region, the counties bordering the Ohio River west of Boone County, the southern tier of counties, and the extreme western counties.

The average length of the growing season, ranging from 176 to 198 days, closely follows in geographic distribution that of the average date of first killing frost in autumn.

The range of the number of days in the growing season for each station probable four years in five, as given in Table 4, may reasonably be taken as typical of the section in which the station is located.

TABLE 3.—*Probabilities of last killing frost in Spring in Kentucky.*

Stations.	Counties.	Elevation.	Length of record.	Average date	Standard deviation	Probable latest dates of killing frost in Spring.							Actual dates of last killing frosts in Spring.	
				A_s.	σ_s.	Even chance.	2 years in 5.	1 year in 3.	1 year in 4.	1 year in 5.	1 year in 10.	1 year in 20.	Earliest date on record.	Latest date on record.
Western division.		*Feet.*	*Years.*											
Blandville	Ballard	445	23	Apr. 10	9.2	Apr. 10	Apr. 13	Apr. 15	Apr. 17	Apr. 18	Apr. 22	Apr. 26	Mar. 25, 1912	May 14, 1895
Earlington	Hopkins	420	24	Apr. 15	8.2	Apr. 15	Apr. 17	Apr. 19	Apr. 21	Apr. 22	Apr. 26	Apr. 29	Mar. 29, 1913	May 1, 1908
Hopkinsville	Christian	524	21	Apr. 12	8.8	Apr. 12	Apr. 14	Apr. 17	Apr. 18	Apr. 20	Apr. 24	Apr. 27	Mar. 29, 1913	May 2, 1909
Marion	Crittenden	571	23	Apr. 12	9.1	Apr. 12	Apr. 15	Apr. 17	Apr. 18	Apr. 20	Apr. 24	Apr. 27	Mar. 25, 1912	May 14, 1895
Owensboro	Daviess	479	20	Apr. 12	9.5	Apr. 12	Apr. 15	Apr. 17	Apr. 19	Apr. 20	Apr. 25	Apr. 28	Mar. 26, 1912	May 2, 1907
Paducah	McCracken	341	24	Apr. 9	8.5	Apr. 9	Apr. 12	Apr. 13	Apr. 15	Apr. 16	Apr. 20	Apr. 23	Mar. 25, 1912	Apr. 25, 1910
Central division.														
Alpha	Clinton	811	23	Apr. 13	7.5	Apr. 13	Apr. 15	Apr. 17	Apr. 18	Apr. 20	Apr. 25	Apr. 26	Mar. 29, 1913	Apr. 24, 1910
Anchorage	Jefferson	700	22	Apr. 18	8.6	Apr. 18	Apr. 21	Apr. 23	Apr. 24	Apr. 26	Apr. 29	May 2	Apr. 1, 1913	May 14, 1895
Bardstown	Nelson	637	20	Apr. 18	10.4	Apr. 18	Apr. 21	Apr. 23	Apr. 25	Apr. 27	May 2	May 5	Mar. 29, 1913	May 3, 1911
Bowling Green	Warren	500	24	Apr. 16	9.3	Apr. 16	Apr. 19	Apr. 21	Apr. 23	Apr. 24	Apr. 28	May 2	Mar. 29, 1913	May 14, 1895
Edmonton	Metcalfe	600	24	Apr. 19	8.9	Apr. 19	Apr. 22	Apr. 24	Apr. 25	Apr. 27	May 1	May 4	Mar. 29, 1913	May 14, 1895
Eubank	Pulaski	1,177	22	Apr. 22	8.5	Apr. 22	Apr. 25	Apr. 26	Apr. 28	Apr. 30	May 3	May 6	Apr. 1, 1913	May 15, 1895
Frankfort	Franklin	560	21	Apr. 14	9.1	Apr. 14	Apr. 16	Apr. 19	Apr. 21	Apr. 22	Apr. 26	Apr. 29	Mar. 25, 1912	May 1, 1908
Franklin	Simpson	691	23	Apr. 12	8.4	Apr. 12	Apr. 14	Apr. 16	Apr. 18	Apr. 19	Apr. 23	Apr. 26	Mar. 28, 1897	Apr. 30, 1908
Greensburg	Green	581	24	Apr. 20	8.7	Apr. 20	Apr. 22	Apr. 23	Apr. 26	Apr. 28	May 1	May 5	Apr. 4, 1896	May 5, 1907
Irvington	Breckenridge	646	20	Apr. 12	9.1	Apr. 12	Apr. 15	Apr. 17	Apr. 18	Apr. 20	Apr. 24	Apr. 27	Mar. 26, 1912	May 1, 1908
Leitchfield	Grayson	635	21	Apr. 15	9.1	Apr. 15	Apr. 18	Apr. 20	Apr. 21	Apr. 23	Apr. 27	Apr. 30	Mar. 29, 1913	May 2, 1909
Lexington	Fayette	989	29	Apr. 16	10.0	Apr. 16	Apr. 19	Apr. 21	Apr. 23	Apr. 25	Apr. 29	May 3	Mar. 29, 1913	May 20, 1894
Loretto	Marion	681	20	Apr. 19	7.8	Apr. 19	Apr. 21	Apr. 23	Apr. 25	Apr. 26	Apr. 29	May 2	Apr. 5, 1903	May 3, 1911
Louisville	Jefferson	525	40	Apr. 10	8.9	Apr. 10	Apr. 12	Apr. 14	Apr. 16	Apr. 18	Apr. 21	Apr. 25	Mar. 25, 1878	May 14, 1895
St. John	Hardin	777	21	Apr. 17	9.7	Apr. 17	Apr. 20	Apr. 22	Apr. 24	Apr. 25	Apr. 30	May 3	Mar. 29, 1913	May 9, 1906
Scott	Kenton	900	20	Apr. 18	5.8	Apr. 18	Apr. 20	Apr. 21	Apr. 22	Apr. 23	Apr. 25	Apr. 28	Apr. 8, 1898	May 1, 1903
Shelby City	Boyle	1,087	24	Apr. 21	9.1	Apr. 21	Apr. 24	Apr. 26	Apr. 28	Apr. 29	May 3	May 6	Apr. 5, 1903	May 9, 1906
Shelbyville	Shelby	825	24	Apr. 17	8.1	Apr. 17	Apr. 19	Apr. 21	Apr. 23	Apr. 24	Apr. 28	May 1	Apr. 5, 1903	May 14, 1895
Eastern division.														
Maysville	Mason	524	21	Apr. 21	10.0	Apr. 21	Apr. 24	Apr. 26	Apr. 28	Apr. 30	May 4	May 7	Apr. 3, 1896	May 15, 1910
Middlesboro	Bell	1,128	24	Apr. 16	8.0	Apr. 16	Apr. 18	Apr. 20	Apr. 22	Apr. 23	Apr. 27	Apr. 30	Mar. 30, 1894	May 3, 1911
Mount Sterling	Montgomery	930	24	Apr. 15	8.5	Apr. 15	Apr. 18	Apr. 19	Apr. 21	Apr. 22	Apr. 26	Apr. 29	Mar. 30, 1913	May 15, 1895
Richmond	Madison	926	23	Apr. 15	8.7	Apr. 15	Apr. 18	Apr. 20	Apr. 21	Apr. 23	Apr. 27	Apr. 30	Mar. 30, 1913	May 2, 1909
Williamsburg	Whitley	939	20	Apr. 15	8.2	Apr. 15	Apr. 17	Apr. 19	Apr. 21	Apr. 22	Apr. 26	Apr. 29	Apr. 4, 1908	May 2, 1909

TABLE 4.—*Probabilities of first killing frost in Fall in Kentucky and probable lengths of growing seasons there.*

Stations.	Average date.	Standard deviation.	Probable earliest dates of killing frost in Fall.							Actual dates of first killing frosts in Fall.		Length of growing season.*					
			Even chance.	2 years in 5.	1 year in 3.	1 year in 4.	1 year in 5.	1 year in 10.	1 year in 20.	Earliest date on record.	Latest date on record.	Average.	Standard deviation.	4 years in 5.		Longest and year.	Shortest and year.
														Practically sure.	Range of probability.		
	A_f	σ_f										l	σ_l				
												Days.		Days.	Days.	Days.	Days.
Western division.																	
Blandville	Oct. 20	9.0	Oct. 20	Oct. 18	Oct. 16	Oct. 14	Oct. 13	Oct. 9	Oct. 5	Sept. 30, 1899	Nov. 8, 1900	194	13.2	170	183 to 205	216, 1897	140, 1895
Earlington	Oct. 17	9.6	Oct. 17	Oct. 15	Oct. 13	Oct. 11	Oct. 9	Oct. 5	Oct. 2	Sept. 30, 1899	Nov. 3, 1900	185	14.4	162	177 to 197	216, 1913	153, 1908
Hopkinsville	Oct. 20	8.4	Oct. 20	Oct. 18	Oct. 16	Oct. 15	Oct. 13	Oct. 10	Oct. 7	Sept. 30, 1899	Nov. 6, 1900	191	12.0	169	181 to 201	207, 1908	163, 1909
Marion	Oct. 16	7.1	Oct. 16	Oct. 14	Oct. 13	Oct. 12	Oct. 10	Oct. 7	Oct. 5	Sept. 30, 1899	Oct. 28 {1908 1910}	187	11.5	166	177 to 197	213, 1912	140, 1895
Owensboro	Oct. 23	9.9	Oct. 23	Oct. 21	Oct. 19	Oct. 17	Oct. 15	Oct. 11	Oct. 7	Sept. 30, 1899	Nov. 9, 1900	194	14.2	169	182 to 206	222, 1912	163, 1909
Paducah	Oct. 23	9.6	Oct. 23	Oct. 21	Oct. 19	Oct. 17	Oct. 15	Oct. 11	Oct. 8	Sept. 30, 1899	Nov. 8, 1900	198	12.1	174	190 to 206	221, 1897	180, 1907
Central division.																	
Alpha	Oct. 18	13.3	Oct. 18	Oct. 15	Oct. 12	Oct. 10	Oct. 8	Oct. 2	Sept. 27	Sept. 14, 1902	Nov. 14, 1900	188	13.1	162	177 to 199	216, 1913	159, 1902
Anchorage	Oct. 17	7.6	Oct. 17	Oct. 15	Oct. 14	Oct. 12	Oct. 11	Oct. 8	Oct. 5	Sept. 30, 1899	Oct. 30, 1897	181	11.2	162	178 to 190	203, 1913	154, 1903
Bardstown	Oct. 17	7.9	Oct. 17	Oct. 15	Oct. 14	Oct. 12	Oct. 11	Oct. 7	Oct. 4	Sept. 27, 1899	Oct. 31, 1908	182	11.1	158	173 to 191	206, 1913	155, 1906
Bowling Green	Oct. 19	8.1	Oct. 19	Oct. 17	Oct. 15	Oct. 14	Oct. 13	Oct. 9	Oct. 6	Sept. 30, 1899	Oct. 29 {1897 1902}	187	12.4	164	177 to 197	205, 1913	140, 1895
Edmonton	Oct. 15	11.4	Oct. 15	Oct. 13	Oct. 10	Oct. 8	Oct. 6	Oct. 1	Sept. 27	Sept. 14, 1902	Nov. 4, 1900	180	14.3	153	168 to 192	206, {1900 1913}	154, 1902
Eubank	Oct. 13	11.5	Oct. 13	Oct. 11	Oct. 8	Oct. 6	Oct. 3	Sept. 29	Sept. 25	Sept. 14, 1902	Nov. 4, 1900	176	13.2	149	165 to 187	203, 1913	154, 1902
Frankfort	Oct. 20	8.6	Oct. 20	Oct. 18	Oct. 16	Oct. 15	Oct. 13	Oct. 9	Oct. 6	Sept. 30, 1899	Nov. 6, 1900	189	12.8	166	178 to 200	213, 1912	170, 1906
Franklin	Oct. 20	9.2	Oct. 20	Oct. 18	Oct. 16	Oct. 14	Oct. 13	Oct. 9	Oct. 5	Sept. 30, 1899	Nov. 4, 1907	191	14.0	169	179 to 203	216, 1897	155, 1908
Greensburg	Oct. 14	12.0	Oct. 14	Oct. 11	Oct. 9	Oct. 6	Oct. 4	Sept. 29	Sept. 25	Sept. 14, 1902	Nov. 4, 1900	178	14.0	151	166 to 190	204, 1900	154, {1902 1908}
Irvington	Oct. 19	7.8	Oct. 19	Oct. 17	Oct. 15	Oct. 14	Oct. 13	Oct. 9	Oct. 5	Sept. 30, 1899	Oct. 31, 1908	190	10.3	168	181 to 199	212, 1912	174, 1899
Leitchfield	Oct. 20	8.6	Oct. 20	Oct. 18	Oct. 16	Oct. 14	Oct. 12	Oct. 9	Oct. 6	Sept. 30, 1899	Nov. 6, 1900	189	10.7	165	180 to 198	206, {1900 1913}	164, 1909
Lexington	Oct. 25	13.1	Oct. 25	Oct. 22	Oct. 19	Oct. 17	Oct. 14	Oct. 9	Oct. 4	Sept. 30 {1895 1899}	Nov. 27, 1902	192	14.1	163	180 to 204	233, 1902	142, 1894
Loretto	Oct. 14	11.5	Oct. 14	Oct. 12	Oct. 9	Oct. 7	Oct. 5	Sept. 30	Sept. 26	Sept. 14, 1902	Oct. 30, 1897	178	12.2	154	168 to 188	201, 1903	154, {1902 1908}
Louisville	Oct. 22	10.3	Oct. 22	Oct. 20	Oct. 17	Oct. 15	Oct. 14	Oct. 9	Oct. 5	Sept. 30, 1899	Nov. 14, 1882	195	14.1	171	183 to 207	223, 1915	140, 1895
St. John	Oct. 17	7.8	Oct. 17	Oct. 15	Oct. 14	Oct. 12	Oct. 11	Oct. 7	Oct. 5	Sept. 27, 1899	Oct. 30, 1897	183	11.6	160	176 to 190	206, 1913	155, 1906
Scott	Oct. 19	8.8	Oct. 19	Oct. 17	Oct. 15	Oct. 13	Oct. 11	Oct. 8	Oct. 5	Sept. 30, 1899	Oct. 30, 1908	184	9.4	166	176 to 192	202, 1898	164, 1901
Shelby City	Oct. 15	11.1	Oct. 15	Oct. 13	Oct. 10	Oct. 8	Oct. 6	Oct. 1	Sept. 27	Sept. 14, 1902	Oct. 30, 1897	177	14.9	151	165 to 189	202, {1898 1903}	152, 1902
Shelbyville	Oct. 17	8.4	Oct. 17	Oct. 15	Oct. 13	Oct. 12	Oct. 10	Oct. 7	Oct. 3	Sept. 30, 1899	Oct. 30, 1897	183	12.3	162	173 to 193	202, 1903	139, 1895
Eastern division.																	
Maysville	Oct. 18	7.9	Oct. 18	Oct. 16	Oct. 15	Oct. 13	Oct. 12	Oct. 8	Oct. 5	Sept. 30, 1899	Oct. 28, 1910	179	13.0	157	168 to 190	201, 1898	154, {1906 1908}
Middlesboro	Oct. 19	10.1	Oct. 19	Oct. 17	Oct. 15	Oct. 13	Oct. 11	Oct. 7	Oct. 3	Sept. 21, 1897	Nov. 6, 1900	184	14.0	163	172 to 196	210, 1908	156, 1897
Mount Sterling	Oct. 19	8.7	Oct. 19	Oct. 17	Oct. 15	Oct. 14	Oct. 12	Oct. 8	Oct. 5	Sept. 30, 1899	Oct. 31, 1908	186	13.8	165	174 to 198	210, 1908	138, 1895
Richmond	Oct. 20	8.5	Oct. 20	Oct. 18	Oct. 16	Oct. 14	Oct. 13	Oct. 10	Oct. 7	Sept. 30, 1899	Nov. 2, 1911	190	12.0	166	180 to 200	206, 1911	164, 1909
Williamsburg	Oct. 22	8.7	Oct. 22	Oct. 20	Oct. 18	Oct. 17	Oct. 15	Oct. 11	Oct. 8	Sept. 30, 1899	Nov. 6, 1900	190	11.4	168	180 to 200	214, 1900	168, 1899

*Number of days between the last killing frost in Spring and the first killing frost in Fall.